Gamma-spectroscopy is an important nuclear and radio-analytical method. Most radioactive sources produce γ-rays of various energies and intensities. When these emissions are collected and analyzed with a γ-spectroscopy system, a gamma energy spectrum can be produced. A detailed analysis of this spectrum is typically used to determine the identity and quantity of γ-emitters present in the source.

Today, γ-spectrometry is one of the most usable methods in different basic and applied fields of **Nuclear Science & Technology**. A variety of instruments and measurement techniques, involving γ-spectrometry measurements, are employed routinely by

- nuclear and radio-chemists,
- health physicists,
- nuclear facility operators,
- radiation protection staff,
- safeguards inspectors,
- border police,
- customs and law-enforcement officers.

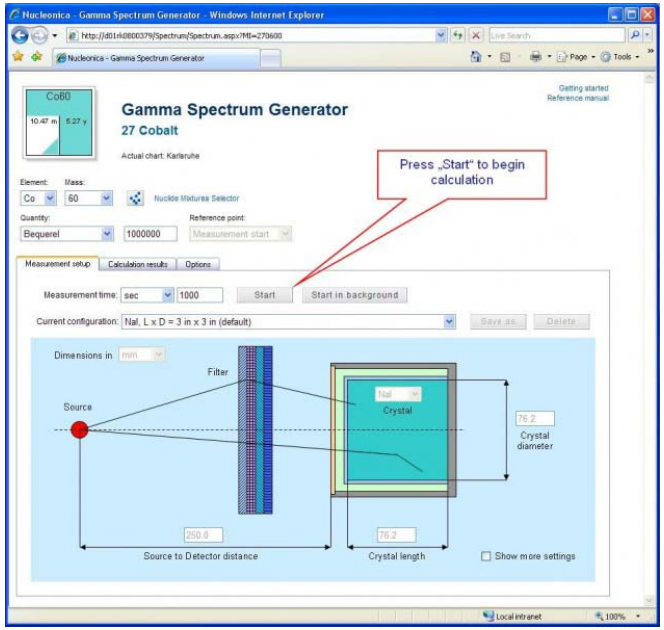
Needs for **Education & Training** in these areas are high and, obviously, they will be increasing in the future as new challenges arise, such as

- strengthening international nuclear safeguards and security,
- nuclear terrorism prevention and
- implementation of new standards in radiation safety and protection.

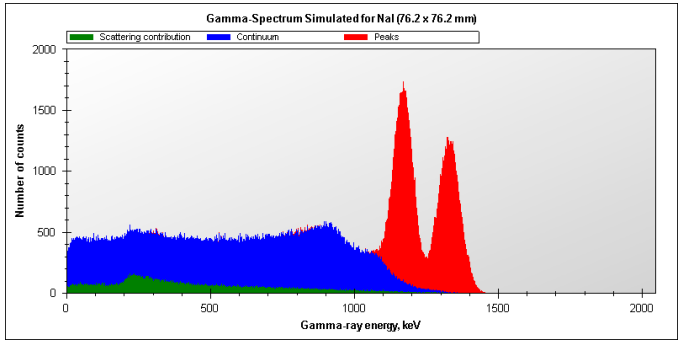
To address these growing demands in Education & Training, an interactive web-accessible simulation tool, the **Gamma Spectrum Generator**, has been developed and integrated into the NUCLEONICA nuclear science portal. The simulator presents an efficient visual teaching aid that is especially useful in training facilities, which have restrictions on the use of radioactive substances, or when sources of special interest (e.g. spent fuel, enriched U, weapon grade Pu or other highly radiotoxic materials) are not readily available.

Getting started with the GSG

The module is setup such that the user can run the program immediately through a simple "one-click" calculation with default parameters.

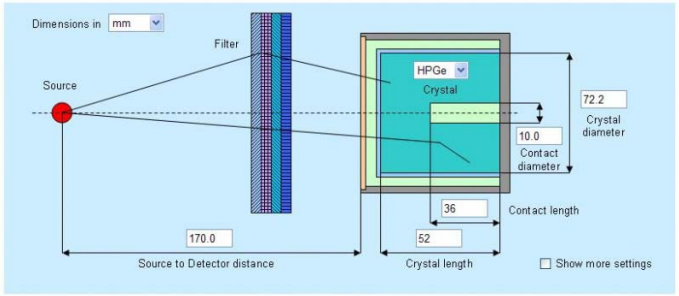


This "one-click" calculation simulates the spectrum for a 10 MBq ^{60}Co γ-source located at 25 cm distance from unshielded 3" x 3" NaI detector. A typical result of the calculation is shown below.

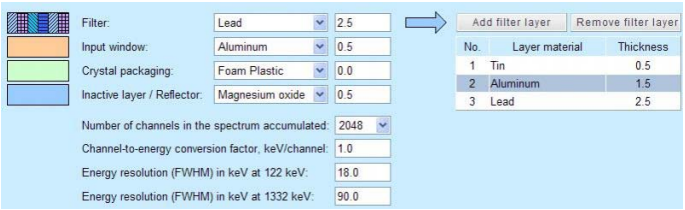


Adapt the GSG to your specific problem

- Choose an appropriate HPGe or NaI detector setup from a set of predefined measurement configurations or define your own setup using the interactive tools provided.



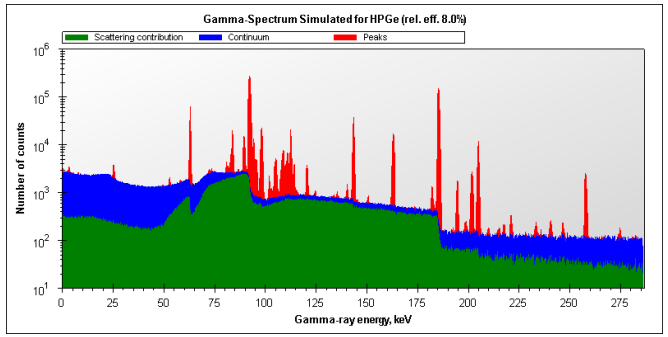
- Define the input window, crystal packaging and inactive crystal layers of the detector setup.
- Add up to 6 additional absorbing filters between source and detector.
- Specify energy resolution properties and ADC settings of the virtual γ-spectrometer.

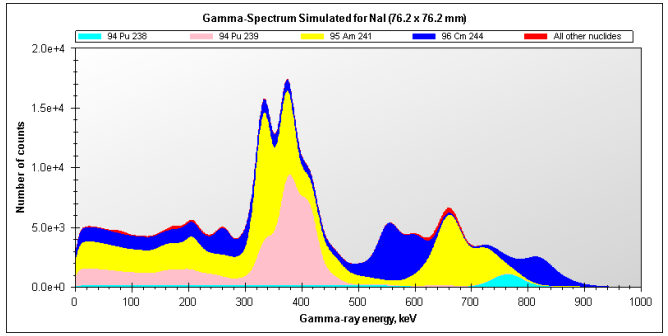


- Save the configuration in your personal NUCLEONICA account for the future use and reference.
- Select from around 1300 γ-emitting nuclides available in NUCLEONICA, or choose a predefined or user-defined mixture of nuclides as a γ-source.
- Specify the source cooling and measurement time intervals and enable decay calculations to let radionuclide decay and buildup during the source cooling and measurement.

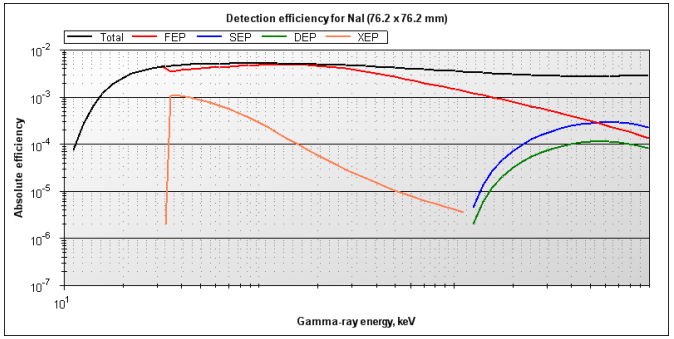
Explore GSG calculation results

- Display nuclide specific contributions or peak, continuum and backscatter photon contributions to the full γ-spectrum.





- Analyze the total and nuclide specific count rates and total number of spectrum counts.
- Display the detection efficiency curves specific to your measurement geometry.



- Customize the appearance of the spectrum and efficiency graphs and download them to your PC in different graphics formats.
- Download an Excel file with the complete collection of spectral and efficiency data plus some other useful information (e.g. minimum detectable activities, filter attenuation corrections etc.).

Further Information

A.N. Berlizov, J. Magill, An Interactive Web Accessible Gamma-Spectrum Simulator, http://www.nucleonica.net:81/wiki/images/0/03/Nucleonica3.pdf

Gamma Spectrum Generator, Nucleonica wiki: http://www.nucleonica.net:81/wiki/index.php/Help:Gamma_Spectrum_Generator

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The Gamma Spectrum Generator

An interactive web-accessible simulation tool in NUCLEONICA

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